Solutions for Power Sector, Utilities & SCADA

IP/MPLS Routers with Cyber Security and Encryption – VCL-MX-5050-R / VCL-MX-5010-R / VCL-MX-5020-R / VCL-MX-5040-R

VCL IP/MPLS (Multiprotocol Label Switching) Routers are designed for applications in rugged and harsh environments, such as utility transmission networks The offered IP/MPLS Routers include built-in cyber security and encryption features to protect customer networks against unauthorized network intrusions.

Features include are:

- IPv4, IPv6, OSPFv2/v3, BGPv4, MPLS, VLAN, VRRP, DHCP, NAT, SNMP, IGMP, QoS, Q-in-Q, NAT, MPLS-TE
- Firewall/Security/Encryption: IPSec, OpenVPN, PBR, L2VPN, L3VPN, Data Encryption, Tunnelling
- 1G, 10G, 40G, 100G interface options
- 1+1 redundant power supply AC/DC options.

STM-1/4/16/64 SDH / OC-3/12/48/192 SONET Multiplexers with MPLS-TP - VCL-1400 / VCL-1600

- STM-1, STM-4, STM-16, STM-64, E1, E3/DS3, FE/GE/10GE MPLS-TP platform
- OC-3, OC-12, OC-48, OC-192, T1, T3/DS3, FE/GE/10GE MPLS-TP platform
- MPLS-TP up to 200 Gbps Fabric and Controller
- OTN (Optical Transport Network) solutions

E1 DXC / E1 PDH Drop-Insert Multiplexers - VCL-MX

- 160Mbps, 80 E1 digital access cross-connect at 64Kbps
- 1+1 E1 Link, Control Card / Cross-Connect, PSU
- IEEE C37.94 and 4 Binary Command Card Teleprotection

Voice and Data Interfaces:

- FXO, FXS, E&M (2 Wire and 4 Wire) and Synchronous / Asynchronous Data: G.703 / V.35 / V.36 / X.21 / RS530 / V.24 / V.11 / V.28 / RS232 / RS485

VCL-9009 Optical Amplifier (EDFA) (Erbium Doped Fiber Amplifier)

- VCL-9009, Optical Amplifier is designed to amplify and boost an optical input and transmit it, without additional mid-span signal repeaters, over extended single mode optical spans. The optical transmitter of the VCL-9009 is designed to increase the output power so that the input optical signal may be transmitted over an extended distance.

  VCL-9009 is a high stability output power EDFA (Erbium Doped Fiber Amplifier) which may be used to provide an optical signal gain of up to 20dBm.

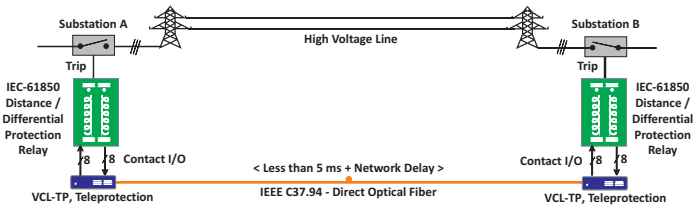
VCL-NAS & Data Storage: VCL Network Access Storage for IT/OT data storage and on-location / off-location critical data back-up.

- Ransomware resilient NAS and Data Storage Servers, up to 1.2 petabytes with Network Isolation Equipment
- Quantum-Safe Encryption
- Vaulted Data Storage through Data Diode
- EMP Protected Data Storage.

Teleprotection (DTPC / Protection Signalling) - VCL-TP

- Stand-alone integrated Teleprotection
- Bi-directional transmission of 8 binary command Inputs and 8 binary command Outputs
- External Trip Counter and Alarm Display unit

Typical Point-to-Point - Application Diagram

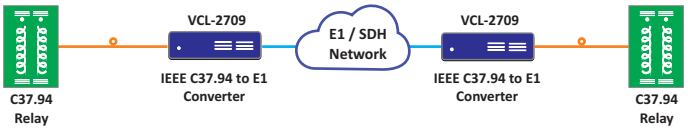


Transmission interface options include:

- E1 (2.048Mbps)
- 1+1, E1 (2.048Mbps), point-to-point transmission links with path protection / route protection with automatic failover
- Dual E1 (2.048Mbps) transmission links transferring 4+4 Binary Commands over E1 links in a point-to-multipoint application
- IEEE C37.94 Optical link
- 1+1 redundant, C37.94 Optical Interface, point-to-point transmission links with path protection / route protection with automatic failover protection
- E1 plus IEEE C37.94 Optical, 1+1 redundant transmission links with path protection / route protection with automatic failover
- Ethernet / IP/MPLS / MPLS-TP (10/100BaseT RJ45; or 100BaseFX Optical) transmission link
- E1 + Ethernet / IP/MPLS / MPLS-TP (10/100BaseT RJ45; or 100BaseFX Optical) transmission link with path protection / route protection
- E1 plus IEEE C37.94 Optical plus Ethernet / IP/MPLS / MPLS-TP (1+N redundant transmission) links
- IEC 61850 GOOSE Over Ethernet / IP/MPLS / MPLS-TP
- Binary Plus IEC-61850 GOOSE (10/100BaseT RJ45; or 100BaseFX Optical)

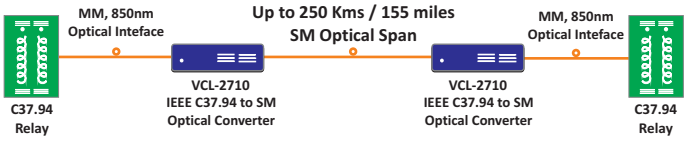
IEEE C37.94 to E1 Converter - VCL-2709 (1E1) / VCL-MX-1554-RAC

- Ruggedized and robust, sub-station-hardened protocol converter that converts the IEEE C37.94 Interface to 2.048Mbps E1 Interface and vice-versa.
- Precise clock recovery and clock re-generation functions which allows transmission of IEEE C37.94 channels over an E1/SDH network for error free transmission.
- Number of IEEE C37.94 interfaces per card: 1 or 4
- Number of interfaces: 1 or 4, E1 (2.048 Mbit/s) Interface(s) (Electrical G.703)



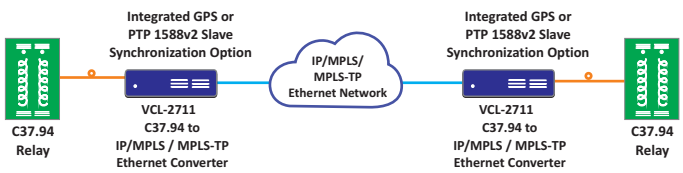
IEEE C37.94 to Optical equipment - VCL-2710

- Ruggedized, sub-station-hardened IEEE C37.94 Multi-Mode to Single-Mode Optical equipment
- Designed to convert and propagate IEEE C37.94 multi-mode signals over extended 1310nm / 1550nm single-mode optical fiber spans
- Includes clock synchronization and clock re-generation functions which transmits the IEEE C37.94 multi-mode signal over single-mode optical fiber links of up to 45dB, 50dB, 55dB, 62dB optical link loss budget (up to 250Kms / 155 Miles).



IEEE C37.94 over IP/MPLS / MPLS-TP - VCL-2711

- Ruggedized, sub-station-hardened transmission equipment which converts and transmits upto 4 x IEEE C37.94 Interfaces over Ethernet / IP/MPLS / MPLS-TP link with “SDH/SONET like” performance.
- End-to-end transmission delay (latency) of < 8ms
- Symmetrical transmission latency with zero transmission errors
- SDH / SONET quality “Jitter” and “Wander” control
- Multiple, integrated clock synchronization options



Phasor Measurement Unit (PMU) - VCL-PMU-30

- Fully integrated, modular phasor measurement unit (PMU) and control solution designed for Synchrophasor systems
- Wide Area Measurement System (WAMS)
- Meets and exceeds C37.118 requirements for P and M class accuracy
- Integrated GPS Receiver with high precision <50 ns clock base, or IEEE-1588v2 PTP Slave
- Best in Class frequency accuracy of 0.001Hz

Grid Islanding and Grid Automation solution

Isolate any area or zone that is threatening to destabilize Power Utility’s power distribution network from within in the event of an impending National Grid Failure, so that the power supply of all downstream feeders and essential consumers remains in healthy condition.

VCL solution scenarios include:

- When the grid frequency falls below a user defined frequency
- When the ROCOF (df/dt) value indicates that the grid frequency shall fall below a user defined frequency, giving us a few extra milliseconds to complete the tripping action.
- When any phase angle of any zone or feeder line deviates from the other zones or feeder lines and goes out of the predefined limits.
- A cyber-attack would normally lead to any one or more of the above deviations.
- In any of the above scenarios occurring, the entire line / feeder tripping process shall be completely automated, with an option of manual intervention.
- Not entirely rely on conventionally regarded "under-frequency" conditions for isolation using the under-frequency and over-frequency feature of the protection relays.

VCL-9025, Optical Multiplexer:

VCL-9025, Optical Multiplexer using WDM (Wave Division Multiplexing) technology is designed to serve Utility and SCADA applications and address the security issues pertaining to critical infrastructure assets. It can be used for the implementation of IT and OT networks over a single fiber pair which include 10G, SDH / SONET as well as Teleprotection (Distance Protection and IEEE C37.94 Line Differential Protection) applications, while preserving the security and reliability of IEC 60834 requirements.

- Each of the 4/8 optical channels are physically multiplexed into a single FIBER on the **transmit** side.
- Similarly, each of the 4 / 8 receive channels are multiplexed into a single FIBER on the **receive** side.
- 4 / 8 distinctly separate optical channels are transmitted / received on a single optical fiber pair.
- It is equivalent to using 4 / 8 separate optical fiber pairs instead of a single optical fiber pair to transmit / receive the 4 / 8 x optical channels. This is made possible by using WDM technology to physically transmit and receive 4 / 8 channels on a single fiber pair.
- VCL-9025 Optical Multiplexer in optical fiber communication systems significantly increases the capacity of the network.
- Helps in increased bandwidth capacity of the fiber, allowing for the transmission of more data and supporting higher data rates, on existing fiber cable.
- Ensures complete security and reliability through physical separation, because each of the 4 / 8 optical channels are transmitted completely independently of each other – even though they are being transmitted on a single optical fiber pair.

Grid Synchronization - PTP IEEE-1588v2, NTP, GPS/GNSS Primary Reference Clock (G.811)

- GPS/GNSS Primary Reference Clocks (ITU-T G.811)
- NTP Time Servers with IRIG-B (GPS, GNSS, NavIC)
- PTP IEEE-1588v2 Grandmaster
- PTP IEEE-1588v2 Slaves
- PTP IEEE-1588v2 Aware Switch
- GPS to IRIG-B, NTP to IRIG-B, PTP to IRIG-B
- Time Distribution unit: NTP Client, IRIG-B (RS-422, RS-232, RS-485), IRIG-B optical, 1PPS, NMEA (0183).
- NTP Server provides up to 16 x 1G/10G NTP outputs and capable of handling up to 1 Million NTP requests per second.

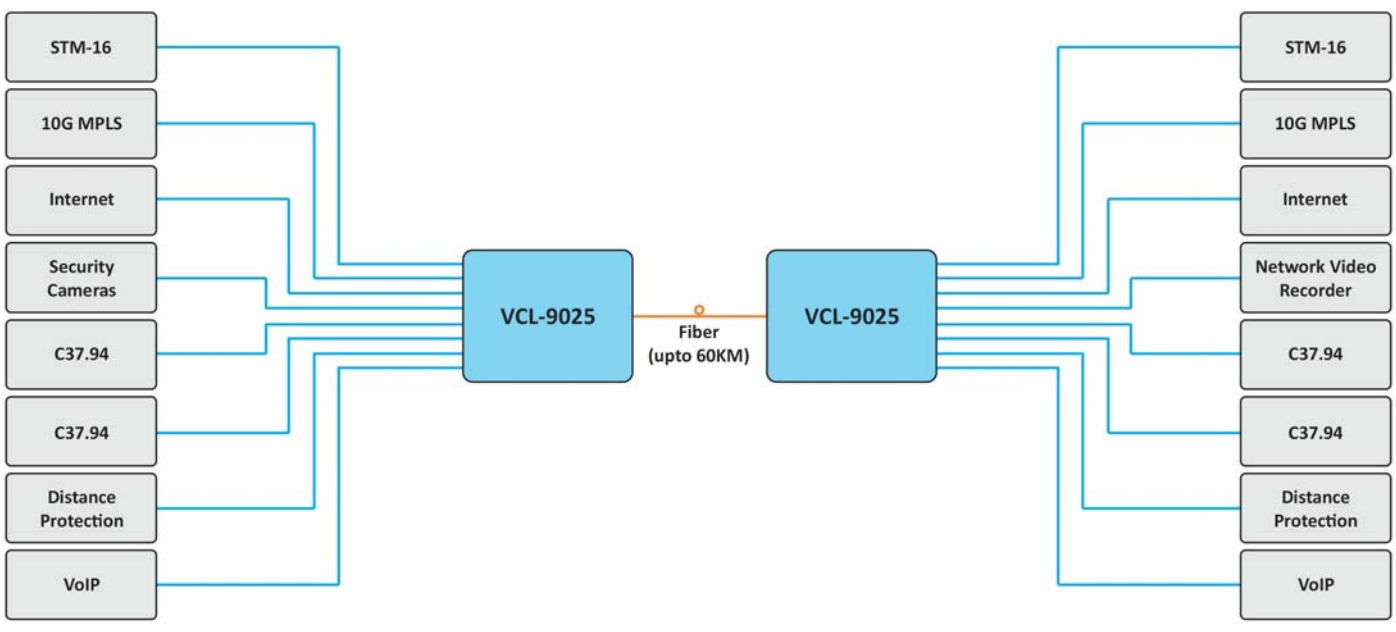
VCL-5051, 10G Optical repeater

- Ruggedized and robust, 3-R 10G Repeater that Re-Generates, Re-Shapes, and Re-Times the 10G optical signal so that it may be extended over long distances on optical links.
- Supports point-to-point applications.

IEC 60870-5-101 to IEC 60870-5-104 Converter

- Converts IEC-101 data to IEC-104 data

VCL-9025, Optical Multiplexer - Application Diagram:



Cyber Security Suite - Prevent, Detect, Secure

Cyber Security Suite - Features:

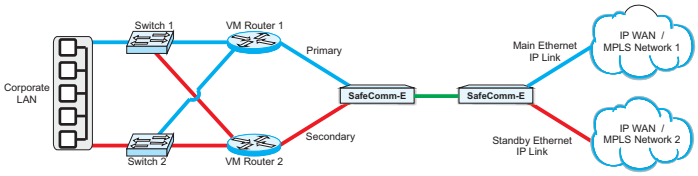
- Automatically executes a counter-defense strategy if a network intrusion / cyber-attack is detected by isolating the critical infrastructure digital assets.
- Provides audio-visual alerts in the event of detection of a network intrusion / cyber-attack.
- Monitoring and visualization of all cyber-security equipment, alarms, and events in real-time.
- Assists in providing forensic analysis in near real-time.
- 1+1 redundancy with automatic failover of LAN equipment and WAN networks.
- No single point of failure in the network for enhanced resilience.

VCL-2702, Network Isolation Equipment:

- Network Isolation in a cyber-attack.
- Isolate NAS, Data Storage, Back-up servers.
- Create LAN / WAN isolation.
- Create operational isolation zones.
- Provides manual and automatic isolation of the Local Area Network from Wide Area Network, in an event of a network security breach / cyber-attack ransomware attack.
- Create Operational Zones or secure parameter zones with the external network isolate the network in the event of the detection of a network intrusion / breach in the cyber-security perimeter of the network's demilitarized zone.
- External triggers using dry-contact alarm relay.
- Failsafe. The unit itself should never becomes a point of failure, even in power down condition.

VCL-2778, Automatic Ethernet Failover Failsafe Equipment:

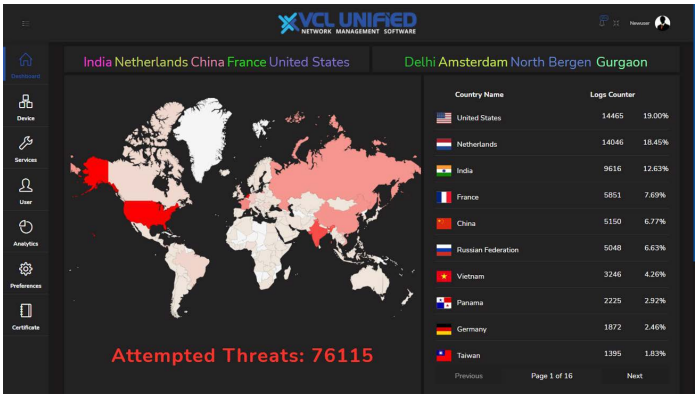
- 1+1 Automatic Ethernet Failover Protection Switches that provide 1+1 Automatic Ethernet Failover / AB Fallback Protection between an "active" and "standby" equipment;
- 1+1 Failover between "main" and "standby" networks are connected to the network through an IP/Ethernet interface.
- Fail-Safe. The equipment never becomes a point of failure. It automatically reverts to the "primary network" / even in a power down condition.
- Monitors end-to-end link connectivity.
- Provides equipment or network redundancy for applications which require 99.99% up-time.



Provides 1+1 Automatic Ethernet Failover Protection between two, IP / Ethernet / MPLS Networks (Primary and Standby Networks).

VCL-2143: Network MouseTrap™ an Advanced Honeypot:

- Early warning systems with detection and alerting of cyber breaches and network intrusion
- Detect network intrusion and firewall breach.
- Detect moles and trojans within existing network
- Intrusion / Network breach detection alarms
- Integrated real-time audio and visual alarms
- Attacker trace root with forensics
- Maintain complete log with timestamp of intruder credentials such as IP address, domain and the originating location details
- Create automated daily, weekly or monthly intrusion detection reports Out-of-band access and security alerts
- White-list / black-list option
- Port based, IP Address based, and IP Domain based programmable filters
- Graphical User Interface (GUI).



VCL-3048, NTP Time Server:

This is a compact NTP Server that is directly locked to a GPS / GNSS reference to provide time synchronization to private networks such Electric Sub-Stations, Power Distribution and Transmission companies, Oil and Gas Utilities, that are required to maintain a complete isolation from public networks for security reasons. Provides the following outputs - NTP, 1PPS, IRIG-B (Unmodulated BNC, RS-232, RS-485 / RS-422).

VCL-2243, RTU Firewall IEC -104 and MODBUS TCP/IP:

VCL-2243 is a high-security, high- reliability, ruggedized, failsafe transparent RTU Firewall that is designed to be installed between the RTU and the SCADA server without having to reconfigure any element of the network. VCL-2243 firewall supports IEC 60870-5-104 (IEC 104) and MODBUS TCP/IP protocol options with extremely advanced features that may be installed to secure and protect RTUs (Remote Terminal Units) in critical infrastructure.

Cyber Security Suite - Prevent, Detect, Secure

VCL-2457: Smart Rack Control Unit:

Compact size, DIN rail mount unit provides monitoring of the health of the telecom racks, alarms including Fan Control Unit for fan management and fan failure alarms for maintaining ambient temperature, 6 additional binary inputs for sensing dry contact relays (open loop / closed loop status) I/Os to monitor, smoke alarm, high temperature alarm, water-logging alarm, Equipment failure alarm etc. May be fully integrated with VCL-UNMS, Centralized Network Management System (NMS) for monitoring the health of multiple racks in the network, from single central location.

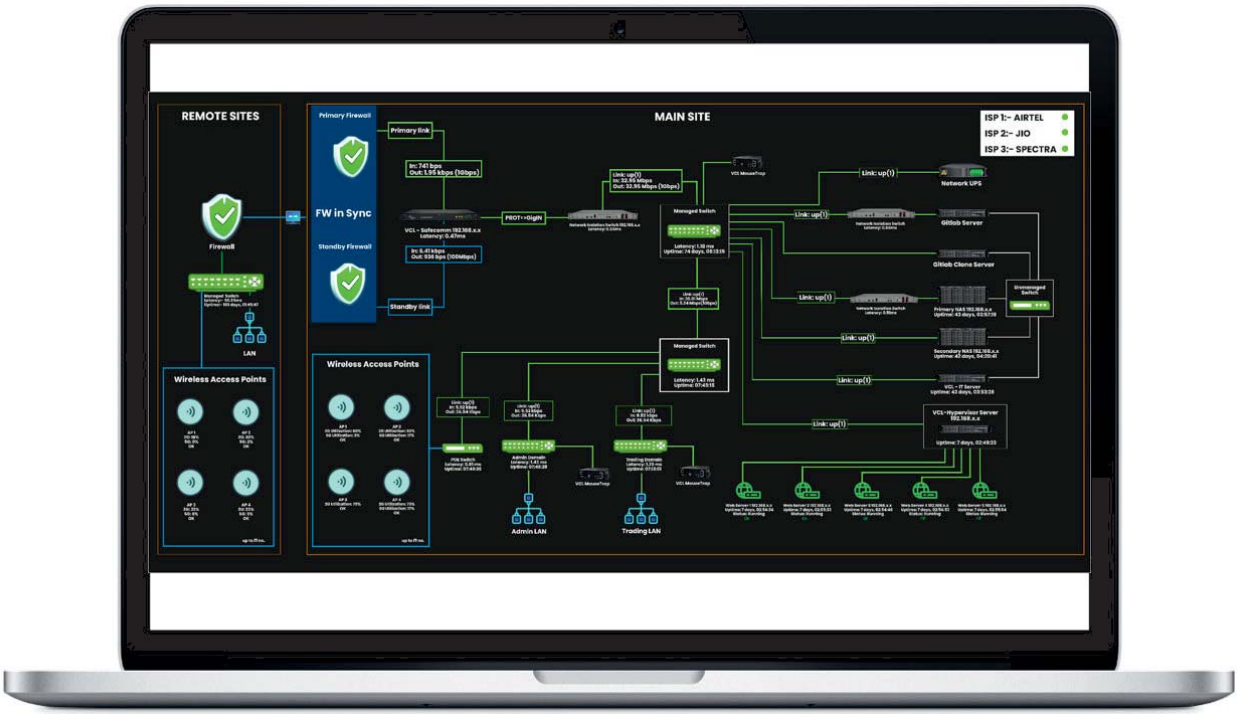
VCL-MX-5050-R-ES, Router with Enhanced Security:

VCL-MX-5050-R-ES is an integrated ruggedized router with enhanced security, encryption and advanced cyber security features that may be installed to secure critical infrastructure such as utilities, sub-stations, SCADA networks, smart-grid distribution systems, airports, railways, IT Networks of financial institutions such as banks and corporate networks. This product is supports for Ethernet, Fast Ethernet, Gigabit Ethernet, Optical Ports with redundant power supply options.

UNMS (Universal NMS):

All these above listed elements can be monitored from our (UNMS) Universal NMS. NMS and network visualization options include:

- UI - User Configuration and Management Utility
- UNMS - Network Monitoring Software for monitoring all elements of a structured NAS
- NVMS - Secure wide network monitoring software for monitoring multiple NAS deployments across the network.



Initial Network Map

Begin by displaying a clean network map diagram showcasing all connected devices, including switches, routers, servers, and other network components. Each device is represented with an icon, and cables depict 'live' connections between them.

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